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ATM Preliminary Design Review Comments and Observations - General Session, Mechanical-Thermal Session, Electrical Session, and Crew Stations Session - Case 620

DATE: October 16, 1968

FROM: S. H. Levine

MEMORANDUM FOR FILE

The ATM Preliminary Design Review (PDR) was held at MSFC in Huntsville, Alabama on September 23 through September 26, 1968.

The following attachments are included as part of this memorandum for the purpose of supplying information and comments relevant to the sessions of the review which the author attended:

1. Attachment A - ATM Preliminary Design Review General Agenda (including Bellcomm attendees, by session).

2. Attachment B - Comments and Observations (on the sessions attended by the author).

3. Attachment C - Review Item Discrepancies submitted by the author.

The purpose of a PDR is to verify by formal review the suitability of the baseline design of the contract end item early in the detail design phase of a program.(1) The PDR represents the culmination of the definition phase of the program, the establishment of a design requirements baseline, and the commencement of configuration control (CCB activity) on the entire system.

Data Package Deficiencies

The data package provided for the review team was insufficient to adequately assess the system performance requirements and design approaches for most of the major ATM subsystems. It is recommended that MSFC produce up-to-date and accurate Part I contract end item specifications for the ATM rack, the ATM experiment package and the Control and Display Console. These

(1) M-D ML-3200 084 Apollo Applications Program Directive No. 11, February 26, 1968.

documents are currently referenced in 50M02417, ATM System General Specification for Performance and Design Requirements. These documents should be subjected to the scrutiny of the review team and be critiqued by the established ATM PDR review item discrepancy (RID) process. Preliminary ICD's for the major functional interfaces with the LM and the cluster should be included as part of this package and should be evaluated by this same process.

Subsystem Deficiencies

Several technical areas were insufficiently covered at the sessions attended by the author and could not, therefore, be adequately reviewed. It is recommended that delta PDR's be considered in the following areas to permit sufficient basis for design assessment and to provide sufficient confidence in the selected design approaches:

a. Mission Timelines

b. Structures

c. Electronics

d. Crew Stations and EVA

e. Development test program status (particularly on new hardware and historically problematic hardware - e.g., tape recorder, computer hardware, PCS sensors and electronics, CBRM's, CMG's, etc.).

Further detail regarding specific failings and findings of the review sessions attended by the author can be found in the attachments previously identified.

S. H. Levine

1024-SHL-li S. H. Levine

Attachments

ATTACHMENT A

ATM PRELIMINARY DESIGN REVIEW GENERAL AGENDA

		Attendees - MLS
Monday, September 23		
1:00 - 4:00	General Briefing	*S. Levine D. Belz
4:00 - 5:00	Mockup Review	*S. Levine
Tuesday, September 24		
8:30 - 3:00	Pointing Control	P. Smith
8:30 - 3:00	Electrical/ESE	*S. Levine
8:30 - 3:00	Mission Req/Oprns.	D. Belz
Wednesday, September 25		
8:30 - 3:00	Pointing Control	J. Kranton P. Smith
8:30 - 3:00	Mechanical/Thermal	*S. Levine J. Waldo J. Gillespie
8:30 - 3:00	Instr. and Commun.	A. Weygand
8:30 - 3:00	Control and Display	None
Thrusday, September 26		
8:30 - 3:00	Crew Station	*S. Levine
8:30 - 3:00	Experiments	T. C. Tweedie, Jr.
8:30 - 3:00	Q&RA/Test/Manufacturing	None

*This memorandum is addressed only to these sessions of the review.

ATTACHMENT B

COMMENTS AND OBSERVATIONS

General Session

1. Mr. Gilino (R-ASTR) discussed pending decisions that could impact the design of the ATM, namely:

a. XUV downlink television in support of the S-082 experiment,

b. authorization for the ATM digital computer (which has since been given),

c. decision on the SLA/Nose Cone versus AS-203 type Aerodynamic Shroud for AAP-4,

d. approval of the Harvard College Observatory requirement for unmanned operation of the modified S-055A experiment after the AAP-3 has returned to earth with the crew,

e. launch to ATM activation timeline analysis,

f. approval of an RF burst monitor device on the ATM for solar flare monitoring in early stages of eruption.

2. Dr. Dozier (R-RP, ATM Experiment Scientist) presented the contamination threat on the AAP-3/4 mission and discussed the work currently being performed in this area. RCS plume models are currently being prepared and an assessment of the expected contamination attributable to plume products on ATM experiments will be made in the near future. Stringent material outgassing control criteria have been instituted on ATM. The intercenter Mechanical Panel is currently examining the entire cluster for potential ATM experiment contamination sources and investigating methods for eliminating or controlling these sources. Dr. Dozier is currently preparing an experiment for measuring contamination in the MSC Thermal Vacuum Chamber A (which utilizes an oil diffusion pumping system) where ATM prototype and flight unit thermal vacuum testing will be conducted.

3. It is felt that additional work is required in the mission operations area to incorporate mission parameters which have previously not been considered by MSFC in both solar observation and timeline planning, namely:

a. thermal stabilization times required by ATM experiment subsystems and the ATM thermal control system,

b. orbit-to-orbit pointing calibration of experiments to the fine sun sensor and of the fine sun sensor to the solar disc centroid,

c. thermal constraints on the timeline prior to achieving orbital operational status on ATM subsystems and experiments,

d. pre-EVA and post-EVA operational requirements,

e. orbit-to-orbit nighttime momentum desaturation maneuvering requirements,

f. contingency (malfunctioned hardware) operations,

g. the possible lack of a teleprinter on board the spacecraft,

h. orbit-to-orbit console adjustments, (e.g., TV tuning, system monitoring, etc.).

It is certain that none of these time consuming items will help the solar observation timeline and may hurt what presently appears to be a marginal satisfaction of principal investigator observation requirements. The duration of the pre-operational phase of ATM (launch, docking and activation) may be greatly affected by the thermal requirements of the system and the available power during this period. Better realism is required in the timeline area to determine whether manual astronaut pointing control system management, proposed as a backup if the digital computer fails, is indeed feasible with the nominal astronaut work load or even with a reduced (contingency) astronaut work load.

4. The radiation environment of the cluster and its possible effect on ATM film were presented at the general session. When interrogated regarding the status of cluster mathematical shielding models, whether unacceptable film fogging is a threat to the ATM, and whether camera shielding, spacecraft shielding, or other more drastic mission alteration measures will be required, the speaker could not respond adequately. In view of the measures taken by the P.I.'s in the usage of less sensitive films, reduction of the cluster altitude, alteration of the orbital inclination, and the degree of uncertainty in mission proton radiation dosage, the author questions the need for undue concern in this area.

Mechanical/Thermal Session

1. The ATM structural discussions did not define or discuss MSFC analytical models for the ATM structure, load distribution paths, or the results of structural analysis done to date on the ATM rack and experiment package. Details could not be obtained on specific load levels or vibration levels transmitted to or by the ATM. Specific questions related to the environment (acoustics and vibration) under the proposed AS-203 type aerodynamic shroud could not be answered.

2. The thermal presentation was excellent from every standpoint. Sufficient data was presented to the review team on thermal analytical model findings, test data, problem areas, hardware requirements and hardware capabilities to adequately assess the thermal system design approach and progress. Unfortunately, due to major rack component layout changes, currently under evaluation, a reassessment and alteration of thermal models for the ATM rack will be necessary. Box, connector and cable run interferences resulting, in part, from inadequate growth provisions for rack mounted hardware have necessitated these pending changes. Layout changes are expected to affect some 75% of the ATM rack components, however, the Charger-Battery-Regulator Modules (CBRM) will not be relocated. CBRM's located on zone 23 of the ATM (the lower quarter panel of the rack facing the CSM in the cluster mission), were heretofore considered a thermal problem area. Excessive temperatures during operation of these units previously required limiting power levels for the ATM electrical power system to 200 watts per CBRM. Due to minor changes (insulation strippage from the experiment package side of the panel and connector relocations) these units now appear to be running well below the upper limits.

Thermal restrictions on the capacity of the CBRM's no longer appear valid and it is currently felt (as Mr. Cagle, R-ASTR stated) that additional power margin is available for this mission. Further analysis is required to determine if the CBRM's can be run at 230 watts average each (the design specification limit for bus feed output) without encountering thermal problems (exceeding the CBRM cell upper limit of 86°F.)

3. Mission timelines currently show that ATM solar array wings will be extended some 12 hours after AAP-4 launch, while the cluster is in an X-POP configuration. Further, the mission timeline also shows that ATM activation will not be completed until some 32 hours after launch, at which time the ATM/Cluster will be nominally pointed at the sun inertially and the ATM pointing control system will assume attitude control of the cluster. With current thermal requirements, it is presently believed that ATM CBRM's will be discharged below the maximum desirable depth-of-discharge (≈30%) some 12 hours after launch (3000 watt-hours of energy expenditure is allowable). RID's B-1 and B-2 (enclosed) were addressed by the author to require close examination of this potential problem area. Further investigation is required to determine the need for supplementary ATM power (primary batteries) or whether other modules of the cluster (AM or LM-A) can help relieve this problem.

4. ATM test planning has established no need for removal of the ATM sun-end "hat" (canister lower cover) after thermal vacuum testing at MSC. Considering the lack of accessibility to the canister-borne experiments and the large degree of handling which is anticipated after thermal vacuum testing (packing for transit, "super-guppy" transit to KSC, unpacking, preparation for checkout, placement in the KSC solar array deployment fixture, removal, stacking, etc.), with the most stringent handling control measures, the susceptability to handling damage and/or experiment misalignment (requiring experiment adjustments) appears to be high. MSFC's reluctance to explore open aperture door checkout and optical path checkout alignment in the MSOB stacked configuration, as well as, KSC experiment package "hat" removal, seems rather optimistic from the standpoint of retention of ATM thermal vacuum checkout integrity.

5. A five-inch vent valve currently is located on the sun-end of the experiment package. This valve requires opening during launch to prevent pressure differentials which would damage the experiment package during ascent and which would provide a path for rapid exposure of the experiment package contents to vacuum and subsequent outgassing. Once space vacuum has been

attained internal to the experiment package, it is highly desirable to reseal this valve and preclude exposure of the experiment package contents to external contamination sources. MSFC has not yet "firmed-up" on how to implement these requirements, but the present philosophy is to utilize an umbilical command (i.e., possibly the lift-off command) for initiating valve opening and to use either an IU or ATM console closure command after venting completion. In view of the fact that both methods being considered for closure of the valve involve electrical functions and are extremely timeline dependent (due to contamination susceptability after venting is completed), it would seem more appropriate to incorporate a normally closed spring actuated (passive) valve for this function. This would automatically close the valve after the differential pressure is removed or after the pressure decays to an extremely low level.

6. MSFC was questioned regarding the advisability of using friction locking of camera access doors during EVA and the susceptability of this type of mechanism to vacuum welding. Assurances were given by the speaker that MSFC is taking the necessary precautions to preclude vacuum welding on all ATM moving parts.

7. Solar array deployment devices have been designed to permit motor reversal, except at the extremes of array deployment, such that if the array wing fails to deploy on the first attempt, the crew can back-up and try again. The ATM Control and Display Console switching, as designed, will not support this capability.

8. It was pointed out that the mainline Apollo CSM was encountering condensation difficulties with coolant lines in the cabin. ATM Control and Display Console designs do not currently consider this potential problem.

9. Bendix reported that their analysis shows that the ATM console can be powered-down to 17 watts heat dissipation during EVA operations (i.e., with the pointing control system in standby and the caution and warning panel in full operation).

10. MSFC has made an effort to provide answers for several Headquarters' comments, pertinent to ATM thermal control, which

had arisen at experiment critical design reviews.(1,2,3) Analysis has determined that after pre-conditioning the experiment package and its contents to 75°F prior to launch, and activation of experiments after docking, it will take approximately 52 hours from the launch of AAP-4 for experiments to reach their stable operating temperature, 70°F. Prior to experiment activation (36 hours after launch), the experiments are expected to reach an average temperature of 40°F.

The spar, upon which the experiments will be mounted, is expected to drop to about 53°F prior to activation of ATM experiments. It is desirable to turn experiment power on and leave the thermal control system (active cooling system) off such that the spar stable operating temperature (≈63°F) can be achieved as quickly as possible. Thermal analysis has shown that using this method, the spar will reach its operating temperature about 68 hours after launch of AAP-4. Additional work will have to be performed by MSFC to determine the optimum time for activation of the thermal control system.

MSFC has shown by analysis that there will be less than 10 arc seconds steady state deflection of the spar due to thermal effects.

11. The effects of EVA operation on thermal control of experiments have been studied in response to Headquarters queries (references previously cited). It was shown that, with the experiment package thermal control system off during EVA (safety consideration), experiment temperatures will drop at a rate of 6°F per hour with LM-end experiment camera doors (AS&E camera doors examined) open and 1°F per hour with these doors closed. The thermal effects of operating sun-end camera doors (for NRL camera access) remains to be examined by MSFC, and appears to be a worst case condition for experiment exposure during EVA.

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(1) Critical Design Review of ATM Experiment S-054, X-Ray Spectrographic Telescope - Case 620, Memorandum for File, July 15, 1968, S. H. Levine and T. C. Tweedie, Jr.

(2) Critical Design Review of the ATM S082A XUV Coronal Spectroheliograph and the S082B XUV Spectrograph Experiments - Case 620, Memorandum for File, August 28, 1968, S. H. Levine and T. C. Tweedie, Jr.

(3) Critical Design Review of Experiment S052, White Light Coronagraph - Case 620, Memorandum for File, April 8, 1968, S. H. Levine and T. C. Tweedie, Jr.

Electrical Session

1. It was stated that the entire power system can be turned on with full operational loading on the system with no damage to ATM electronics. In recent weeks this area had been considered a potential problem, since the ATM console has very little load controlling or load switching capability. This was of particular concern in instances when shutdown of all CBRM's was called for (power system emergencies, etc.) followed by start-up with all loads on the system.

2. Batteries of the CBRM's, built by General Electric, are rated at a minimum output voltage of 26.4 volts DC and at charge-discharge lifetime of 1000 cycles. With a real time mission life for ATM of approximately 50-55 days, the total charge-discharge cycles will be in the order of 825 cycles not including ground checkout and testing operations. The CBRM designed lifetime appears marginal and probably requires further examination.

3. CBRM battery heaters will have proportional heater control. Twenty watt heaters will be switched on when batteries are at +10°C and will operate at 100% capacity at 0°C. Battery heater sizing and requirements are currently very preliminary.

4. The ATM Control and Display Console caution and warning lights will illuminate a "Power System" warning display with any of the following functional problems:

a. battery voltage high or low,

b. battery temperature high ($>$ 35°C; the battery will cut itself off when the temperature exceeds 50°C),

c. CBRM output voltage low,

d. battery charge not complete.

5. It was stated that CBRM acceptance testing will not include flight qualification vibration levels. The first time the CBRM performance will be monitored with qualification vibration test performance levels will be during electrical power system testing. Solder joint integrity, battery cell isolation, and module structural integrity may not be verified until a point in the program when considerable impact can be expected, if problems occur.

6. MSFC has examined unmanned rendezvous and docking program requirements and has determined that no problems (e.g., power degradation) are expected due to LM-A RCS propulsion disposition or thermal effects on the outer panels of the folded ATM solar array.

7. Practically no discussion of ATM electronics hardware was given during the electrical session. The electrical session was specifically devoted to power sources, power distribution and transfer and electrical networks design. Fundamental electronic design philosophy, selected electronics assemblies, standard circuit applications, electronic packaging, application of space proven hardware, etc., must be openly reviewed in order to confirm the soundness of and the consistency of ATM electronics design philosophy. Specific areas where development test data would have been desirable, at this stage of the program, were on Charger-Battery-Regulator Modules or subassemblies of these modules, the ATM Auxiliary Storage and Playback Recorder, PCS sensors, T.V. System, and subsystem breadboards.

8. Logic diagrams and/or subsystem functional schematics and Interface Control Drawings (preliminary), which are necessary for design analysis by the review team, were not available. An assessment of the system design, which is the function of the PDR, must include planned hardware approaches. In order to evaluate hardware approaches, this type of data must be made available. It is impossible to know the level of system automation, critical subsystem functions and interfaces, and, in general, the soundness of design approaches without this material. Specific examples of the types of detail designs which are presently under program scrutiny, but which could not be assessed with the data presented, are:

a. the dependence of other system operations on the performance of the digital computer,

b. the logic behind the ATM caution and warning system and the degree of system compatibility with the cluster caution and warning system philosophy,

c. the specific functioning of the ATM Control and Display Console (what happens to the system, when particular switches are thrown on the console?).

Crew Stations Session

1. Recommendations from the Intercenter EVA Working Group making EVA from the LM the primary method for film camera retrieval on the AAP-3/4 mission, have been adopted by program management at both Centers (MSC and MSFC). Design changes are currently underway to simplify film retrieval and to make the LM-end crew station of the ATM more readily accessible from the LM front hatch. The new crew station locations are expected to cut down umbilical length requirements from 60 feet to about 25 feet.

2. MSFC presented film cargo transfer concepts utilizing a cargo carrier which is rail mounted and of similar design to the "dolly" concept currently being considered for the S-IVB orbital workshop "fireman's pole" cargo transfer device. MSFC design criteria limits the ATM device, as currently conceived, to 100 lbs. This device will be capable of permitting the EVA astronaut to ride on it along with the ATM camera cargo for sun-end film camera retrieval and will be capable of carrying the full complement of LM-end film cargo. Adequate restraint for the astronaut at three points or more is provided with this cargo/crew transfer concept. Stowage of this device, prior to usage, presents a potential problem, since storage room in the LM and external to the LM is currently marginal. RID G-1 (enclosed) was prepared by the author and addresses itself towards examination of the total cluster cargo transport problem rather than just the isolated EVA activity in support of ATM. A working model of the proposed MSFC cargo transfer device is currently being manufactured and should be available by November 1 for evaluation by the LM/ATM EVA Working Group.

3. It would be grossly unfair to evaluate the adequacy of the Crew Station Session of the ATM PDR, since the joint MSFC and MSC LM/ATM EVA Working Group has not completed work in this area. The designs presented were merely conceptual and it should be recognized that discussion on this subject was included merely to provide a forum for current Center "thinking" on the subject. All attendees agreed that a delta PDR would be necessary for crew stations and EVA. The author feels that more attention should be focused on the total EVA/IVA cluster (intra and inter modular) crew tasks and designs by this intercenter working group rather than just those associated with EVA for ATM film retrieval.

ATTACHMENT C

REVIEW ITEM DISCREPANCIES SUBMITTED BY THE AUTHOR

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
S.H. Levine - MLS/Bellcomm		9-25-68

SUBSYSTEM	ITEM DRAWING NO/SPEC	WORKING GROUP

THE REVIEW ITEM DISCREPANCY IS:

Deployment of ATM RF antennas on two wings of the solar array does not require additional pyrotechnics and separate deployment devices.

a. Incorporate antenna deployment as part of the solar array wing deployment scissor designs.

b. Eliminate the ATM C&D switches associated with antenna deployment.

c. Eliminate the requirement for separate pyrotechnics and associated switching and circuitry to support antenna pyrotechnics.

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	B-1

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
Levine, S. – MLS/Bellcomm		9/24/68

SUBSYSTEM	ITEM	WORKING GROUP
C.	Power Requirements during Predocking Phase DRAWING NO/SPEC	Electrical & ESE, Working Group B

THE REVIEW ITEM DISCREPANCY IS: Determine what power is required during the predocking phase of the mission for thermal conditioning of ATM and experiment subsystems. Determine if the ATM electrical power system, as baselined, can adequately support these requirements.

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	B-2

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
Levine, S. – MLS/Bellcomm		9/24/68

SUBSYSTEM	ITEM	WORKING GROUP
Elec.	Power Requirements during ATM Activation DRAWING NO/SPEC	Electrical & ESE, Working Group B

THE REVIEW ITEM DISCREPANCY IS: Determine if power requirements during activation of the ATM can be met with existing cluster orientation (POP Mode) constraints (ref. –Hardy–Burgland Committee Report). This analysis should consider but should not be limited to:

(a) Possible Thermal Conditioning power required prior to and during this phase.
(b) Solar array deployment power (TM antenna utilization and system power).
(c) TM system operation (e.g. Tape recorder).
(d) PCS operation (Star Tracker and Acquisition Sensors, CMA Thermal Conditioning and Spin–up Power Requirement).
(e) Operation of the C and W system on the C&D Panel.
(f) Operation of the C&D panel prior to solar–inertial orientation of the ATM (no experiments operating).

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE–BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	D-1

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
LEVINE, S. -- MLS/BELLCOMM		9/25/68

SUBSYSTEM	ITEM	WORKING GROUP
MECHANICAL	DRAWING NO/SPEC	MECHANICAL-THERMAL

THE REVIEW ITEM DISCREPANCY IS:

DETERMINE THE EVA HANDLING REQUIREMENTS, THE QUANTITY, THE LOCATION AND SPECIFIC MOUNTING REQUIREMENTS FOR EVA SECONDARY OXYGEN SUPPLY BOTTLES WHICH REQUIRE MOUNTING ON THE ATM, IN CLOSE PROXIMITY TO THE CREW EVA WORK STATION. (REF. RID 7-4 RESPONSE FOR LM-A PRR).

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center REVIEW	NUMBER
ATM PDR		D-2

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
S. LEVINE -- MLS/BELLCOMM		9/25/68

SUBSYSTEM	ITEM	WORKING GROUP
MECHANICAL	DRAWING NO/SPEC	MECHANICAL-THERMAL

THE REVIEW ITEM DISCREPANCY IS:

DETERMINE IF THE STAR TRACKER INNER AND OUTER GIMBALS ARE CAPABLE OF BEING LOCKED IN PLACE IN SUCH A MANNER THAT THE UNIT WILL SURVIVE LAUNCH PHASE AND DOCKING ENVIRONMENTS WITH NO MARKED DEGRADATION OF PERFORMANCE.

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	D-3

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
LEVINE, S. -- MLS/BELLCOMM		9/25/68

SUBSYSTEM	ITEM	WORKING GROUP
MECHANICAL	DRAWING NO/SPEC	MECHANICAL-THERMAL

THE REVIEW ITEM DISCREPANCY IS:

PROPOSALS CURRENTLY BEING CONSIDERED FOR AAP-4 INCLUDE THE USAGE OF AN AERODYNAMIC SHROUD WHICH INCORPORATES AN AS-203 TYPE NOSE CONE. IS THE ATM CAPABLE OF SUSTAINING THE ENVIRONMENT EXPECTED WITH THIS CONFIGURATION DURING BOOST (LOADS, ACOUSTICS, ETC.)

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

I-S/AA-20 9/11/68

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	D-4

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
LEVINE. S. -- MLS/BELLCOMM		9/25/68

SUBSYSTEM	ITEM	WORKING GROUP
MECHANICAL	DRAWING NO/SPEC	MECHANICAL-THERMAL

THE REVIEW ITEM DISCREPANCY IS:

DETERMINE THE MECHANICS FOR CLOSING THE EPXERIMENT PACKAGE VACUUM VENT VALVE AFTER WE HAVE REACHED ORBIT. (DETERMINE WHETHER THE C&D CONSOLE REQUIRES SWITCHING).

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PPE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	D-5

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
LEVINE, S. -- MLS/BELLCOMM		9/25/68

SUBSYSTEM	ITEM	WORKING GROUP
MECHANICAL	DRAWING NO/SPEC	MECHANICAL-THERMAL

THE REVIEW ITEM DISCREPANCY IS:

GRUMMAN HAS IDENTIFIED A SINUSOIDAL LAUNCH VIBRATION INPUT FROM PRIMARY LM-A STRUCTURE TO SECONDARY LM-A STRUCTURE OF 2.69 x 1.3 (SAFETY FACTOR) = 3.5g peak @ 18.5 to 100 cps. THE TRANSMISSIBILITY OF LM-A SECONDARY STRUCTURE IS IN THE ORDER OF 10 TO 15. THESE NUMBERS ARE SAID TO BE BASED ON GRUMMAN LM EXPERIENCE AND TEST DATA.

A. WHAT PEAK AMPLITUDES AT THESE FREQUENCIES ARE CURRENTLY ESTIMATED TO BE DELIVERED BY THE ATM TO THE LM-A AT THE STRUCTURAL INTERFACE?

B. WHAT TRANSMISSIBILITY FACTORS ARE CURRENTLY BEING USED BY MSFC TO EXPERIMENTS AND SYSTEM COMPONENTS FORMING WHAT IS ESSENTIALLY ATM "SECONDARY STRUCTURE?"

C. ARE ATM CAMERAS CURRENTLY DESIGNED TO SUSTAIN THE LM-CPSM VIBRATION ENVIRONMENT, AS DEFINED.

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	D-6

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
LEVINE, S. -- MLS/BELLCOMM		9/25/68

SUBSYSTEM	ITEM	WORKING GROUP
○ MECHANICAL	DRAWING NO/SPEC	MECHANICAL-THERMAL

THE REVIEW ITEM DISCREPANCY IS:

THE TOTAL EXPERIMENT PACKAGE WEIGHT CURRENTLY EXCEEDS THE REPORTED DESIGN LIMITS OF THE PERKIN-ELMER GIMBAL RINGS (5000 ± 10%#). WHAT ARE THE PLANS FOR MAINTAINING THE REQUIRED SAFETY FACTOR AND REMAINING WITHIN ESTABLISHED CONTROL WEIGHTS FOR THE EXPERIMENT PACKAGE?

JUSTIFICATION/RECOMMENDATION

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

TYPE REVIEW	NASA - Marshall Space Flight Center	NUMBER
ATM PDR	REVIEW	G-1

INITIATOR & ORGANIZATION	SENIOR REPRESENTATIVE	DATE
S. Levine, HQ/MLS/Bellcomm	D. Forsythe HQ/MLA	9/26/68

SUBSYSTEM	ITEM	WORKING GROUP
	Cargo/Astronaut Translator DRAWING NO/SPEC	Crew Station

THE REVIEW ITEM DISCREPANCY IS:

1. Film cargo transfer internal to and external to the cluster should not be addressed separately.

a. The film cargo transfer device which will ultimately be chosen for ATM EVA should be adaptable for internal cluster cargo transfer to minimize the number of these types of units in the cluster (and attendant weight and stowage penalties) and to reduce handling and training procedures for the astronauts (with different units).

b. Providing thermal protection for cameras & magazines which may be exposed to solar flux during EVA should be considered in cargo transfer device design.

c. Reduction of crew tasks in film transfer activities (internal and external to the cluster) should be a prime requirement in cargo transfer device design.

d. Consideration of rescue obstructions to an EVA crew member who may encounter troubles is required.

e. The stowage of the proposed cargo transfer device must be cleared with Grumman.

BOARD DISPOSITION

CATEGORY	ACTION	SUSPENSE DATE

REMARKS

PRE-BOARD CHAIRMAN	BOARD CHAIRMAN
☐ APPROVED ☐ DISAPPROVED	

BELLCOMM, INC.

Subject: ATM Preliminary Design Review Comments and Observations - General Session, Mechanical-Thermal Session, Electrical Session, and Crew Stations Session - Case 620

From: S. H. Levine

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